A Device for Measurement of the Thermal Conductivity of Solids, Liquids, and Gases at High Temperatures and Pressures.

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A device is described based on the method of flat horizontal layers with heat shielding which allows investigation of the thermal conductivity of substances over the temperature range 100 – 650 K at different pressures, including phase transitions and the critical state. This device contains the measuring plates and the cell. The measuring cell is made of copper and constantan. inside the shield system, we can create directed flow of heat from the inner heater plate down to the cooler plate, through a layer of the substanceof interest. The heat loss from the inner heater is controlled by three shield cylinders-two are made of constantan and the third, positioned between them coaxially, the main shield, is made of a heat and electrical insulator. The electric signal from the surface differential thermocouple is proportional to the temperature difference between the surfaces of the main shield cylinder, and a signal of zero means the absence of heat flow through the cylinder. The main shield cylinder is made of a heat and electrical insulator with low thermal conductivity (asbestos cement) and has a thickness of 0.0005 – 0.001 m. The cell for measurement consists of two disks made of homogeneous the stainless steel and supplied with thermocouples for T and dT. The stainless steel was chosen because of its high corrosion resistance, low thermal conductivity and it is a standard material for thermal conductivity. The upper disk is called the hot plate, and the lower is called the cool plate. The cell delivers a liquid or a gas through the channels in the cool plate, leading to the space between the hot and cool plates and the spacer separating them. The cell for measurement, positioned under the measuring cell and being brought in close contact with the cell for measurement by pressing, is placed into the autoclave. The error of the thermal conductivity measurement is within 1%. Using the described apparatus, the thermal conductivity was investigated for the reference material – distilled water, and of solutions, porous media, saturated by fluids over a wide range of parameters.